

## STS 128 Return Samples: Assessment of Air Quality aboard the Shuttle (STS-128) and International Space Station (17A)

The toxicological assessments of 2 grab sample canisters (GSCs) from the Shuttle are reported in Table 1. Analytical methods have not changed from earlier reports. The recoveries of the 3 surrogates (<sup>13</sup>C-acetone, fluorobenzene, and chlorobenzene) from the 2 GSCs averaged 110, 102, and 103 %, respectively. Based on the end-of-mission sample, the Shuttle atmosphere was acceptable for human respiration.

Table 1. Analytical Summary of Shuttle Samples

Sample Location	Date of Sample	NMVOCs <sup>a</sup> (mg/m <sup>3</sup> )	Freon 218 (mg/m <sup>3</sup> )	T Value <sup>b</sup> (units)	Alcohols (mg/m <sup>3</sup> )	Formaldehyde (μg/m <sup>3</sup> )
Preflight	8/28/09	0.2	0	0.01	0.1	--
Flight-deck (end mission)	9/11/09	6.0	130	0.24	0.9	--

<sup>a</sup> Non-methane volatile organic hydrocarbons, excluding Freon 218

<sup>b</sup> Calculated excluding CO<sub>2</sub>, formaldehyde, and siloxanes.

The toxicological assessment of 8 GSCs and 6 pairs of formaldehyde badges from the ISS is shown in Table 2. The recoveries of the 3 standards (as listed above) from the GSCs averaged 89, 99 and 94%, respectively. Two formaldehyde-badge lab controls averaged 90% recovery.

Table 2. Analytical Summary of ISS Results

Module/Sample	Approx. Date	NMVOCs <sup>a</sup> (mg/m <sup>3</sup> )	Freon 218 (mg/m <sup>3</sup> )	T Value <sup>b</sup> (units)	Alcohols (mg/m <sup>3</sup> )	Formaldehyde (μg/m <sup>3</sup> )
Lab	5/28/09	--	--	--	--	35
SM	5/28/09	--	--	--	--	31
Lab	7/3/09	--	--	--	--	32
SM	7/3/09	--	--	--	--	22
SM	7/28/09	6.4	170	<b>3.3<sup>c</sup></b>	3.3	27
Lab	7/28/09	3.6	150	0.3	2.6	21
Columbus	7/28/09	3.4	160	0.3	2.3	--
Lab	8/3/09	4.3	170	0.6	3.1	--
MPLM (first entry)	9/1/09	20	30	<b>2.0</b>	<b>9.4</b>	--
SM	9/3/09	5.6	190	0.9	4.0	--
Lab	9/3/09	3.6	180	0.3	2.7	--
JEM	9/3/09	3.7	170	0.3	2.7	--
<i>Guideline</i>		<25	<i>none</i>	<1.0	<5	<120

<sup>a</sup> Non-methane volatile organic hydrocarbons, excluding Freon 218

<sup>b</sup> Calculated excluding CO<sub>2</sub>, formaldehyde, and siloxanes.

<sup>c</sup> High T value is due to traces of propenal, an irritant. Other aldehydes were also present in this sample.

The Freon 218 values suggest a steady state over the period of the sampling with new sources and minimal scrubbing in balance. The T-values are generally within acceptable range (<1); however, one value was elevated due primarily to trace amounts of propenal, a potent mucosal irritant. The crew has not reported any eye or upper airway irritation associated with the SM atmosphere from this time period, and the elevated T-value was

confined to a single module. The lack of time-resolution in sampling confounds our ability to identify a source.

The first-entry sample from the MPLM showed a high T-value, as expected, before the MPLM atmosphere was dispersed into the ISS atmosphere and the pollutants became highly diluted and scrubbed. The compounds with a T-value contribution greater than 0.1 included the following: 2-methyl furan, benzene, fluorotrimethylsilane, trimethylsilanol, and carbon monoxide. The large value for alcohols was primarily due to 2-propanol, which probably originated from ground-based "cleaning" of surfaces. The fact that there was 30 mg/m<sup>3</sup> Freon 218 in the MPLM sample proves that some mixing of the ISS atmosphere into the MPLM had occurred before the sample was acquired.



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Enclosures

Table 1A: Analytical concentrations of compounds found in the STS-128 GSCs

Table 1B: Analytical concentrations of compounds found in 17A GSCs

Table 2A: T-values of the compounds in table 1A

Table 2B: T-values of the compounds in table 1B